

# **Newsletter**

**Volume 15, Number 5**  
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## **Director's Note**

IES has just turned 15 years old. I'm very proud of our accomplishments. Since fall 1983, our scientific staff has more than tripled. These scientists have published some 760 research papers in peer-reviewed journals, and have written or edited 24 books. IES educators teach budding ecologists of all ages, and thirty doctoral students have been supervised by Institute scientists. Cary Conferences, held here every other year since 1985, have tackled issues at the forefront of ecology. Of the 21 sites in the nationwide Long-term Ecological Research (LTER) Network, IES is a major player in two, the Hubbard Brook Ecosystem Study and the Baltimore Ecosystem Study. A new computer network links us to each other and to the Internet. Our display gardens and greenhouse have never looked better, and the buildings and grounds are in top condition. We have raised \$5 million toward a \$6 million goal in the Campaign for the Institute of Ecosystem Studies. And all these programs are facilitated by a strong administrative support staff.

My thanks to all those whose hard work has helped to bring us closer to our goal of excellence during the past 15 years.

The *IES Newsletter* is published by the Institute of Ecosystem Studies, located at the Mary Flagler Cary Arboretum in Millbrook, New York.

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## **Dr. Cadenasso Moves from the Rural Edge to the Urban Interior**

Forest edges are everywhere in the contemporary landscape, as parcels of woodland are cleared for agriculture or development. The last we looked in on Mary Cadenasso, her research on local forest edges was focused on learning how fields and forests exchange materials, and what role the edge plays in controlling this exchange. Discoveries from this research, which was first introduced to *IES Newsletter* readers in the July-August 1996 issue, are the focus of her recently completed doctoral thesis. Now, Dr. Cadenasso is embarking on a new research project, as an IES postdoctoral associate facilitating the sampling of vegetation for the Baltimore Ecosystem Study.

### **Structure and Function of Forest Edges**

A forest edge is the interface between a forest and open land. In her thesis research, Dr. Cadenasso studied such interfaces at the Mary Flagler Cary Arboretum, learning about how organisms, solar energy, nutrients and pollutants interact with edges.

What is moving, actively and passively, across the forest edge? And what features of the edge influence this movement? Dr.

Cadenasso compared an intact edge with an experimentally thinned one, where small trees and shrubs were removed and side branches cut from larger trees to alter the vegetation structure on the edge. The altered structure mimicked what a newly created forest edge looks like before vegetation has filled in. She collected data over five field seasons, and discovered several things. First, an intact edge functions as a barrier to wind-dispersed seeds, potentially preventing invasion of the forest by non-native species. Second, voles are the dominant herbivore in intact edges but not in thinned ones, where deer are dominant. Since seedlings frequently do not resprout when they have been browsed by voles, seedling survival is reduced in intact edges. These discoveries indicate that edge structure itself may have an impact on the density and composition of plant communities along interfaces between forests and fields.

Dr. Cadenasso's work is significant because habitat fragmentation — a consequence of human activity — is increasing world-wide, and boundaries between habitats are prominent features in the landscape. "Consequently," she writes in her dissertation, "habitat patches are smaller, and a greater proportion of the habitat core is close to a boundary so the probability of interacting with contrasting habitat types is high." Boundaries, though they occupy a relatively small space on the ground, may have the big job of mediating influences from outside the habitat that could affect processes inside the habitat. Dr. Cadenasso's research has brought a fuller understanding of exactly what goes on in these rapidly proliferating boundaries, and of what jobs they may be performing.

### **Now, on to Baltimore ...**

Last year, the Institute of Ecosystem Studies was awarded a federal grant to study "Human Settlements as Ecosystems: Metropolitan Baltimore from 1797 - 2100" (*IES Newsletter*, November-December 1997). Under Dr. Steward Pickett, IES senior scientist and project director for the Baltimore Ecosystem Study (BES), scientists, educators, sociologists and economists are collaborating to examine



Dr. Mary Cadenasso is studying the vegetation of Baltimore.

*continued on page 3*

# Freshwater Mussels Go Fishing

Biodiversity. It's a hot topic, and we often read about declining species diversity and richness in distant corners of the world. Little is written, however—at least in the popular press—of similar declines much closer to home. In North American lakes, rivers and streams, for example, many species of fish and shellfish are struggling to survive, and a number already have become extinct.

Dr. David Strayer is an aquatic ecologist at the Institute. He is an expert on pearly mussels—mollusks of the order Unionoida—and recently co-authored *The Pearly Mussels of New York State* (March-April 1998 issue of the *IES Newsletter*). He says that there are 300 species of pearly mussels in North America (only one of which is also found elsewhere), most in the eastern half of the continent. Unfortunately for the mussels, their abundance has coincided with areas of rapid human development, and approximately 10% of these endemic animals are now extinct. "Maybe a quarter of the remainder are considered 'secure', if their habitats don't change dramatically," Dr. Strayer explains, "but the rest—probably 200 species—are in some degree of trouble." According to a 1996 Nature Conservancy report, unionids are the largest group of federally listed endangered or threatened invertebrate animals. Here in New York, approximately 50 species of pearly mussels were known historically, and from six to 12 are no longer found here. The remainder, notes Dr. Strayer, are ranked from "secure" to "medium rare".

Dr. Strayer says that there is a tendency to equate biodiversity with lists and numbers: What are the creatures called? How many are left? He feels that to better understand questions of species diversity and richness, we must learn more about the organisms themselves. How do they behave? What are their relationships with the other types of organisms they live with? What fascinating adaptations do

they show? "There are maybe half a dozen laboratories around the country now using non-traditional approaches to study freshwater mussels," Dr. Strayer continues. "Catherine Corey's work at IES is part of this small groundswell of research looking at these mussels and how they behave."

## Mussels and Fish

As a graduate student at the State University of New York at Albany and the Institute of Ecosystem Studies, with Dr. Strayer as her advisor, Ms. Corey is combining her interests in behavioral ecology and conservation biology in a study of rare pearly mussels. Her research focus is on several species in the genus *Alasmidonta*, and since these species have all but disappeared from local waters she searches for them in the clear-flowing Neversink River, which runs 60 miles from the Neversink Reservoir in the Catskill Mountains to the Delaware River in New Jersey. The behaviors that Ms. Corey is investigating are related to mussel reproduction, and even early in her study she is making interesting discoveries.

Freshwater mussels have a fascinating life cycle that includes a brief stage as parasites. Males release sperm to the water currents, and with any luck these currents sweep by female mussels that filter the sperm from the water to fertilize their eggs. In the mussels' gills, the eggs mature to larvae called glochidia. Larval mussels cannot survive on their own, and this is where fish come in. When they are released from the female mussels, glochidia attach to either the gills or fins of fish. After several weeks of metamorphosis, juvenile mussels, which now resemble miniature adults, drop off onto the sediments to begin their lives as filter feeders. By hitching a ride on fish, they give the mussel population as a whole a better chance of survival, through dissemination to new sites.

Other mussel species attract fish by means of a modification to their mantle—the sheet of tissue lining the animal's shell—that in some mussels looks remarkably like a small minnow, even down to an eyespot. Little is known about display behaviors in mussels, and it is one of the things that Ms. Corey is investigating.

Glochidia come in two types, those with tiny hooks and those without. Scientists have assumed that mussels that have hooked glochidia do not display. These scientists believe that there is no need for this behavior because the larvae are capable of attaching securely to a host fish. Ms. Corey and Dr. Strayer, however, suspect that an animal will do all it can to survive, and therefore it is quite possible that mussels with hooked glochidia do indeed show display behavior.

In the IES laboratory, Ms. Corey set up aquaria and video equipment, then collected living specimens of *Alasmidonta* and two species of minnows that serve as hosts for their glochidia. *Alasmidontines* have hooked glochidia, and Ms. Corey was prepared to watch whether or not they used display behavior during the period in spring that they typically release their glochidia. But, due to elevated water temperatures in April, the release was some six weeks early this year and had happened before she collected the mussels. Ms. Corey returned the animals to the sites where she had collected them and turned her attention to a summer-releasing species, the eastern pond mussel *Ligumia nasuta*. When she trained her video camera on the aquarium housing this animal, not only did she capture it displaying a rippling mantle, but she also recorded a bluegill trying to eat this intriguing lure! This was the first observation of this display in *Ligumia*, so, after 180 years of being just a name on a list—the species had been identified in 1817—the eastern pond mussel now has a whole new dimension: behavior. Ms. Corey is showing her video as a poster display at the upcoming New York Natural History Conference in Albany, N.Y.

Ms. Corey is also studying where juvenile mussels go after they have metamorphosed on their host fish, and what prompts them to drop off. Could there be chemical cues in the water indicating the presence of other mussels? In the IES laboratory, she has 12 two-liter soda bottles filled with well water, each containing a golden shiner. To each, she will add glochidia released by a species of *Alasmidonta*. After a week, she will replace the well water in six of the bottles with



Ms. Catherine Corey was the first to record display behavior in the eastern pond mussel.

To draw fish in close enough for their glochidia to reach, female mussels go fishing! Some species attract the attention of hungry fish by releasing a glochidia packet shaped to look like fish food—a worm or a tiny fish. When the glochidia are sucked in through the fish's mouth, they grab on to the gills and encyst.

## Mussels, *continued*

water from aquaria in which *Alasmidonta* have been kept. By comparing the rate at which juvenile mussels fall off host fish in the treated bottles with the rate in the controls, she hopes to garner evidence for chemical cues in the water and their use by juvenile mussels to determine a good drop-off spot.

Next spring, well before the release of glochidia, Ms. Corey will be back in the Neversink River to collect mussels and fish. She will apply techniques she piloted this year to studies of the federally endangered dwarf wedge mussel, *Alasmidonta heterodon*, and other *Alasmidontines*.

Learning more about the animals' ecology and behavior has direct links to



*Little is known of the behavior of the federally endangered dwarf wedge mussel, Alasmidonta heterodon. Ms. Corey will be studying these animals next spring. [Drawings by Helen Winchester, from The Pearly Mussels of New York State by D. L. Strayer and K. J. Kirka, published in 1997 by the New York State Museum. Numbers 7 and 7a, female; number 8, male.]*

conservation of the species. For example, Ms. Corey explains, if water quality is compromised and the host fish cannot see a displaying mussel due to turbid water or rapid flow, the reproductive success of these mussels may be decreased. Investi-

gating the interactions between mussels and their host fish will contribute to efforts to create the best habitat possible for maximum survival of these endemic animals.

## Rural to Urban, *from page 1*

Baltimore and its surroundings as an ecological system ... the first time this is being done in an urban environment. Dr. Cadenasso will be characterizing vegetation in the BES field sites, and integrating this knowledge with work on soil and biogeochemical processes coordinated by IES microbial ecologist Dr. Peter Groffman and U.S. Forest Service forest ecologist Dr. Richard Pouyat\*, and with data from other working groups on the project — hydrology, social, economic, etc.

### The Gwynns Falls Watershed, from Top to Bottom

The Baltimore Ecosystem Study is examining the entire Baltimore metropolitan area with the 17,000 hectare (over 42,000 acre) Gwynns Falls Watershed as a primary focus. To learn as much as possible about the vegetation in such a vast and varied expanse of land, sampling is being done in small, intensively studied permanent plots as well as along transects that span the entire watershed.

The BES permanent plots have been laid out in areas representative of different social contexts — low and high density population, old and new housing, etc. For many years to come, plant ecologists will document the vegetation on these plots

while ecologists from other disciplines will monitor a range of other parameters, building knowledge across the system on long-term natural and human-accelerated change.

Under Dr. Cadenasso's direction, distribution and patterns of vegetation on a broader scale will be studied along transects spanning the entire Gwynns Falls Watershed. Teams of research assistants will walk the transects to quantify what is on them — forest with herbs and shrubs, mowed grass, vacant lot, paved road, etc. When transects cross populated areas, the BES collaborators will work with residents to survey lawns, garden plots ... even window boxes. Dr. Cadenasso explains: "It may turn out that different populations choose different plants to cultivate, and these data may prove to be useful in understanding ecological fluxes and social patterns in the watershed."

Some of the questions that can be answered with the BES vegetation data include: With movement up the watershed, toward suburbia, is there a change in the identity of plant communities? And, if there is, can the change be related to urbanization? In analyzing the data, Dr. Cadenasso will be looking to see how vegetation structure and composition and ecosystem processes change along the gradient up each watershed. She will then integrate the vegetation results with the data of the other BES collaborators to develop the most detailed picture possible of an urban ecosystem.

### Baltimore's Boundaries

One of the facts of life in science is that questions answered lead to more questions asked. In her graduate research, Dr. Cadenasso documented the role of Hudson Valley forest edges in mediating the exchange of organisms and materials between forests and adjacent fields. Now, in addition to the work she is doing with BES, she will be starting a new research project to study boundaries in Baltimore.

Her first task will be to determine which type of boundary is important in this new system. In the Hudson Valley, deciduous forest edges are a prominent boundary type in the landscape. However, in Baltimore the prominent boundary type may be between paved and unpaved surfaces, or between land and water, or between some other combination of features. In the Baltimore landscapes, forest edges are adjacent to cemeteries, or golf courses, or mown grass, but generally not open fields. She will then design field studies to learn if forest edges in Baltimore perform the same functions as forest edges in the Hudson Valley, and if there is a general function of boundaries in the landscape that is consistent regardless of the landscape itself.

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*Dr. Mary Cadenasso, recently appointed an Institute of Ecosystem Studies post-doctoral associate, received her Ph.D. from Rutgers University in May 1998. IES ecologists Drs. Steward Pickett and Kathleen Weathers were collaborators on her forest edge research.*

\* Like Dr. Cadenasso, Dr. Pouyat received his doctoral degree through a collaborative program between IES and Rutgers. Dr. Pouyat is a scientist with the USDA Forest Service, an IES visiting scientist, and a co-principal investigator with the Baltimore Ecosystem Study.

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# Newsletter

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## Calendar

### IES SEMINARS

Free scientific seminars are held each Friday at 11:00 a.m. at the IES Auditorium:

Oct. 30: **Propagation of Ecological Interactions Across Realistic Landscape Space.**

Dr. William A. Reinert, The University of Wyoming, Laramie

Nov. 6: **Natural Selection as a Tool for Ecology: Examples from Habitat Selection.** Dr. Douglas Morris, Lakehead University, Thunder Bay, Ontario

Nov. 13: Topic: **Soil and microbial ecology.** Dr. Carole Klopatek, Dept. of Microbiology, USDA-FS, University of Arizona, Tempe

Nov. 20: Director's Program for Visiting Scientists: **Climate Change, Avian Malaria, and Land Use: Predicting the Fate of Endemic Avian Populations in the Hawaiian Islands.** Dr. Tracy L. Benning, Dept. of Environmental Science, Policy and Management, Ecosystem Science Division, University of California at Berkeley

Dec. 4: **Determinants of Nest Predation: Density, Behavior or Contingency.** Dr. Kenneth Schmidt, Institute of Ecosystem Studies

• *Check the IES Website for last-minute updates.*

### VOLUNTEER OPPORTUNITIES

For information on volunteering at IES, call Ms. Su Marcy at 914/677-7641. Current opportunities include assisting customers and visitors in the Ecology Shop, computer work for the Continuing Education Program, and clerical assistance for the IES Volunteer Program.

### HOURS

Winter hours: October 1 - March 31

Closed on public holidays.

**Note:** The trails and roadways are closed from November 16 through December 8 for the managed deer hunt. Trails and roadways also are closed when they are snow/ice covered.

**Public attractions** are open Mon. - Sat., 9 a.m.-4 p.m. & Sun. 1-4 p.m., with a free permit\*.  
(The Greenhouse closes at 3:30 p.m. daily.)

The **IES Ecology Shop** is open Mon.-Fri., 11 a.m.-4 p.m., Sat. 9 a.m.-4 p.m. & Sun. 1-4 p.m. (The shop is closed weekdays from 1-1:30 p.m.)

\* *Free permits are required for visitors and are available at the IES Ecology Shop or the Education Program office daily until 3 p.m.*

### IES ECOLOGY SHOP

**New in the Shop ...** IES totebags ... 1999 calendars ... batik pins ... candles ... **for children ...** new science and nature books ... **and in the Plant Room ...** plant markers and carbon pencils ... toad homes ... kidskin gardening gloves  
**Senior Citizens Days:** 10% off on Wednesdays  
**Dec. 5 and 6 ... Annual Holiday Sale:** Saturday, Dec. 5 from 10 a.m. - 3 p.m.; Sunday, Dec. 6 from noon - 3 p.m. 10% discount! Free refreshments!

• • Gift Certificates are available • •

### MEMBERSHIP

Join the Institute of Ecosystem Studies. Benefits include subscription to the newsletter, member's rate for courses and excursions, a 10% discount on IES Ecology Shop purchases, and participation in a reciprocal admissions program.  
Individual membership: \$30; family membership: \$40. Call Ms. Janice Claiborne at 677-5343.

**The Institute's Aldo Leopold Society**  
In addition to receiving the benefits listed above, members of The Aldo Leopold Society are invited guests at spring and fall IES science updates. Call Ms. Jan Mittan at 677-5343.

### TO CONTACT IES ...

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... for education, general information and the IES Ecology Shop:

Institute of Ecosystem Studies  
Education Program, Box R  
Millbrook NY 12545-0178

Tel: 914/677-5359 • Fax: 914/677-6455

IES Ecology Shop: 914/677-7649

Street address: Gifford House Visitor and  
Education Center, Route 44A, Millbrook, N.Y.

...IES Website: [www.ecostudies.org](http://www.ecostudies.org)

### CONTINUING EDUCATION

For a fall 1998 catalogue and program information, call the Continuing Education office at 914/677-9643. Programs during November and December include:

#### *Landscape Design*

Nov. 3 (7 sessions): **Landscape Design I**

Nov. 18 (5): **Graphics II**

#### *Gardening*

Nov. 7: **Luminous Bloom: The White Garden**

Nov. 15: **Establishing Native Wildflower Meadows**

#### *Natural Science Illustration*

Nov. 7 (5): **Botanical Watercolor II**

Nov. 9 (6): **Drawing II: Illustration**

#### *Biology and Earth Science*

Nov. 1: **American Indian Ethnobotany and Ethnomycology**

#### *Workshops*

Nov. 14: **Elements of Garden Design** with Joe Eck

Nov. 15: **Designing and Planting a Native**

**Wildflower Meadow, Part I** (Part II will be Feb. 20 and 21, and Part III will be May 22)

#### *Natural Crafts*

Nov. 7: **Pressed Flower Creations**

Nov. 21: **Festive Fall Flower Arrangement**

Dec. 5: **Fresh Green Holiday Wreath**

Dec. 19: **Fresh Holiday Arrangement**

### SUNDAY ECOLOGY PROGRAMS

**Free public programs** are offered on occasional Sundays. Call 914/677-5359 to confirm the day's topic or, in case of poor weather, to learn the status of the day's program. Meet at 2 p.m. at the Carriage House behind the Gifford House on Route 44A for:

Dec. 6: **An Origami "Wetland Ecosystem"**, led by Jill Cadwallader

### GREENHOUSE

The IES greenhouse, a year-round tropical plant paradise and a site for controlled environmental research, is open until 3:30 p.m. daily except public holidays. Self-guided Economic Botany Trail. Admission is by free permit (see "HOURS").